POSEIDON Cruise 242 Walter Zenk, Chief Scientist, 20.08.98

Cork - Reykjavik

Cruise Report

1 Introduction

POSEIDON cruise 242 is the second expedition in a row of cruises which let us to the Iceland Basin. The main objective of our research interest lies in the transformation of watermasses in this ocean basin which is a major part of the subpolar gyre of the North Atlantic. Elements of hydrography in this region include the North Atlantic Current, the spreading of Labrador Sea Water and the Iceland Scotland Overflow Water along the Middle Atlantic Ridge. This work is part of the Special Research Initiative *Sonderforschungsbereich 460* (SFB) at the University of Kiel.

Our observations were started over one year ago during METEOR cruise 39 in May/April 1997. Besides an intensive hydrographic survey we had deployed an array of three current meter moorings north of Charlie Gibbs Fracture Zone. Its objective was to monitor the Overflow Water for over one year. In addition we launched 17 RAFOS floats in the Iceland Basin. It was our primary aim on POSEIDON to recover and partly redeploy these moorings and supplement the array of Lagrangean observations at the depth level of the Labrador Sea Water, i.e. at approximately 1500 - 1700 m depth. In addition we had planned a row of underway CTD stations.

2 Participants

Dr. Walter Zenk	Chief Scientist	Institut für Meereskunde (IfM) Kiel
Karina Affler	Student	University of Kiel
Sylvia Becker	Dipl.-Ozeanographin	IfM Kiel, SFB
Christjan de Boer	Student	University of Kiel
Dieter Carlsen	Technician (TA)	IfM Kiel
Heiner Dietze	Student	University of Kiel
Peter Meyer	Dipl.-Ing. (FH)	IfM Kiel
Andreas Pinck	Dipl.-Ing. (FH)	IfM Kiel, SFB

3 Narrative and First Results

The scientific party on board the POSEIDON consisted of eight persons, all affiliated to the *Institut für Meereskunde an der Universität Kiel* (IfM). Immediately after embarkation on 31 July we installed the necessary equipment in the port of Cork. All gear had been shipped by trailer and a container from Kiel within one week. On 2 August at 8:00 POSEIDON left Cork under favorable weather conditions and sailed towards her area of interest, the Iceland Basin. On the way to the first mooring position (Fig 1) we took a series of CTD stations at a nominal latitude of 51° N in repetition of last year's METEOR cruise 39. This repeat CTD section represents the southern hydrographic boundary of the Iceland Basin (Fig 2).

Early in the morning on 4 August we reached the first station (no. 379) where we took a CTD cast. The inventory of all CTD stations is compiled in Table 1. During the following two days we cruised westward towards mooring position **T**. Steady westerly winds at the northern rim of the Azores high reduced the ship's speed to about 7 knots. After a series of five more CTD stations we reached point **T** on the morning of 6 August (Sta 384). Without any difficulties mooring **T** was launched within less then two hours. Details about all mooring activities are summarized in Table 2. At the same station we also launched our first RAFOS float (IfM 481).

The following days saw the deployment of moorings **R** and **A** (7 Aug), and **M** (8 Aug) on the same zonal section east of the Middle Atlantic Ridge. It is the purpose of this current meter array to monitor intermediate and deep watermass spreading South of Charlie Gibbs Fracture Zone, i.e. beyond the local source region for Labrador Sea Water, respectively, the drain for Iceland Scotland Overflow Water.

The recovery of moored instruments is scheduled for the summer of 1999 when we plan to return to the site with the METEOR again. In parallel to these Eulerean observations we deployed further RAFOS floats at the level of Labrador Sea Water, including the refurbishment of southern float park (IfM 462, 483,484, 485) of METEOR cruise 39. All these Lagrangean measurements are compiled in Table 3.

After the termination of a short meridional CTD section (Fig 3) east of Charlie Gibbs Fracture Zone (Sta 393-397) with the reestablishment of the float park we occupied a second quasi-zonal section (Fig 4) orthogonal to the Middle Atlantic Ridge just North of Charlie Gibbs Fracture Zone (Sta 397-409). This section corresponds to the METEOR section **D** (M39). It brackets the current meter array of moorings OWW (**V386**), OWM (**V387**) and OWE (**V388**). By 11 Aug all three moorings were completely recovered (see for details Table 2). Examples

of preliminary data from mooring V388 are shown in Fig 5 and 6. Fig 7 contains mean current vectors from all instruments that we processed already on board the POSEIDON.

Among the recovered instruments in mooring V387 was a RAFOS sound source (International code IM3) which was moored at site OWE since the METEOR cruise 39. After a short electronic check-up of this instrument it was remoored at the same position only a few hours later (**V388-02**). This sound source as well as all other instruments were in excellent shape showing no or only minimal traces of corrosion.

On 10 Aug we managed for the first time during our cruise to locate and recover a freely drifting RAFOS float. This particular instrument, which was recovered after we had completed Sta 401, originally was moored since May 1998 at the northern float park site east of Charlie Gibbs Fracture Zone. It had finished its underwater mission a few days prior to the beginning of our POSEIDON cruise. We were able to locate the drifting float by messages from the computer center of SYSTEME ARGOS in Toulouse and in the near range by the special radio receiver GONIO. The recovery exercise lasted less than two hours and was highly successful. During the course of our cruise we captured three additional drifting ARGOS platforms (RAFOS floats). For details see Table 3.

On 13 Aug we steamed under unfavorable weather conditions northeastward parallel to the main axis of the Reykjanes Ridge. After midnigth of the following day we proceeded with a long CTD section (see Fig 1) between the Ridge and Rockall Bank featuring Sta 410 - 419. On every station deeper then 2000 m we deployed RAFOS floats for the observation of the Labrador Sea Water drift. On 16 Aug strong winds and considerable swell disabled us from taking CTD cast 418. We had to wait for several hours for more favorable weather conditions. As already on the western side of our CTD section (Sta 409) we recovered closely to the eastern most station (419) another float from the 1997 campaign of the METEOR. The final approach towards the southern tip of Iceland was occupied by a series of CTD stations (419 - 429) where we again seeded a number of floats on stations with depth >2000 m.

The scientific work was finished on 19 Aug, 13:57, not before we had managed to recover a fourth drifting RAFOS float from May 1997 at Sta 424. The remaining time had been utilized for five more CTD stations complementing the meridional section along 20° (Sta 419 - 429) south of Iceland. A special delight for everybody on board the POSEIDON was the close encounter with the famous vulcano island of Surtsey, which came in sight on 19 Aug late in the afternoon. On the morning of 21 Aug POSEIDON called port in Reykjavik where cruise no. 242 was terminated at 8:00 LT.

4 Summary of observations

A compilation of all work is given in the attached ROSCOP form. We counted 43 CTD casts, the deployment of 20 RAFOS floats, the recovery of three current meter moorings of which one was partially reployed after an instrument check. Unplanned was the recovery of four intact RAFOS floats that had surfaced on schedule at originally unknown locations after 15 month long underwater missions. The combined communication between our colleagues at IfM Kiel and occasional direct computer links to SYSTEME ARGOS in Toulouse via INMARSAT had enabled this additional highlight of a successful cruise.

5 Acknowledgments

We thank the *Deutsche Forschungsgemeinschaft* for providing financial support for our observational work in the subpolar gyre of the North Atlantic. We explicitly acknowledge the excellent cooperation with *Kapitän* M. Kull and his crew and look forward to our next exciting visit to the Iceland Basin in the summer of 1999.

5 Tables

5.1 CTD Inventory

STILL MISSING

5.2 Mooring Activities

Status: 20.08.98 18:40

Ship	Sta No.	Int. No.	IfM No.	Date	Latitude North	Longitude West	Depth (m)	Instr. Type	Remarks incl. nominal instr.depth
Current Meter Moorings									
Pos 242	385	T	V393↓ -01	06 Aug. 1998	51°31.93'	023°46.00'	3527	CB	27.035Mhz, Argos 2267
								ACM 8	No.12004@1700m
								ACM 8	No.10076@2600m
								ACM 8	No.11617@2900m
								ACM 8	No.9820 @3100m
								ACM 8	No.9727 @3300m
								ACM 8	No.11618@3550m
Pos 242	388	R	V392↓ -01	07 Aug. 1998	51°32.40'	026°16.63'	3840	CB	27.035Mhz, Argos 5507
								ACM 8	No.10077@2600m
								ACM 8	No.9816 @2900m
								ACM 8	No.9313 @3200m
								ACM 8	No.9312 @3600m
								ACM 8	No.11621@3950m
Pos 242	389	A	V391↓ -01	07 Aug. 1998	51°32.00'	027°20.43'	3415	CB	27.035Mhz, Argos5510
								ACM 8	No.10075@1700m
								ACM 8	No.9732 @2600m
								ACM 8	No.10663@2800m
								ACM 8	No.9345 @3100m
								ACM 8	No.9831 @3350m
Pos 242	392	M	V390↓ -01	08 Aug. 1998	51°31.80'	028°30.48'	2535	CB	27.035Mhz
								ACM 8	No.9322 @1700m
								ACM 8	No.9730 @2600m
								ACM 8	No.9344 @2800m
								ACM 8	No.9731 @2950m
M39/2	246	IM3	V388↓	29 May 1997	53°14.60'	030°16.00'	3087	SoSo	No.23, Win.01:30Z
								ACM 8	No.10078@1350m
Pos 242	399	IM3	V388↑	10 Aug. 1998				ACM 8	No.8412 @2200m
								ACM 8	No.9819 @2500m
								ACM 5	No.6159 @2750m
								ACM 5	No.8575 @3150m (Compass failed)
M39/2	242		V386↓	31 May 1997	54°17.1'	032°57.00'	2724	ACM 8	No.12051@1350m
								ACM 8	No.9812 @2100m
Pos 242	405		V386↑	11 Aug. 1998				ACM 5	No.7929 @2350m
								ACM 5	No.7927 @2550m
M39/2	249		V387↓	27 May 1997	53°50.2'	031°43.60'	2858	ACM 8	No.10074@1350m
								ACM 8	No.9311 @2200m
Pos 242	403		V387↑	11 Aug. 1998				ACM 5	No.4570 @2500m
								ACM 5	No.4563 @2750m (Leakage - no data)
Sound Source Mooring									
Pos 242	401	IM3	V388↓ -02	10 Aug. 1998	53°14.50'	030°16.00'	3084	CB	27.035MhzArgos2262
								SoSo	No.23

ACM 5 Aanderaa current meter RCM 5
ACM 8 Aanderaa current meter RCM 8
SoSo Sound Source
↓ set
↑ recover
CB Short Wave Transmitter
ARGOS Watch Dog

5.3 Float Launches/ Recoveries

Status: 20.08.98 18:40

Sta No.	IfM No.	Date Z	Time	Latitude North	Longitude West	ARGOS (DEC)	Mission (month)	Remarks
Dual Release RAFOS float launches ↓								
394	483(#)	09/08/98	01:00	51°50.11	029°31.21'	5481	2 + 15	(Float
394	484(#)	09/08/98	01:07	51°50.15'	029°31.10'	5482	4 + 15	Park
394	485(#)	09/08/98	01:13	51°50.14'	029°31.09'	5488	6 + 15	South, revisited)
RAFOS floats ↓								
385	481(#)	06/08/98	09:47	51°31.86'	023°46.25'	5466	15	@ Mooring T
394	462(F)	09/08/98	00:51	51°50.09'	029°31.30'	4981	15	Float Park South
401	464(F)	10/08/98	14:51	53°14.46'	030°15.73'	4983	18	@ Mooring V388
404	463(F)	11/08/98	12:55	53°50.46'	031°44.44'	4982	18	@ Mooring V387
412	469(F)	14/08/98	12:38	57°44.66'	030°17.41'	4989	15	↓--
413	473(F)	14/08/98	19:05	57°37.14'	028°43.62'	5467	24	
414	474(F)	15/08/98	00:23	57°25.97'	027°11.54'	5491	24	Quasi-zonal section
415	465(F)	15/08/98	09:12	57°18.02'	025°38.10'	4984	18	@ 57 ½°N
416	466(F)	15/08/98	15:49	57°08.22'	024°01.87'	4986	18	
417	480(#)	15/08/98	22:40	56°57.96'	022°32.08'	6843	18	
418	472(F)	16/08/98	10:03	56°49.37'	020°58.39'	5460	15	↓↑--
422	467(F)	17/08/98	15.44	59°29.02'	020°01.13'	4987	18	
423	476(F)	17/08/98	20.22	59°57.45'	020°00.84'	12611	24	
424	477(F)	17/08/98	23:26	60°22.07'	020°00.11'	12612	24	Meridional
425	478(F)	18/08/98	11.23	60°59.09'	019°59.92'	12623	24	Section @ 20°W
426	468(F)	18/08/98	17:50	61°24.81'	020°01.24'	4988	18	↑--
RAFOS float recovery								
	413(F)	28/05/97	20:38↓	53°31.90'	031°02.20'	4377	4 + 10	(ex Float
		10/08/98	20:58↑	53°59.39'	029°59.81'			
	412(F)	28/05/97	18:07↓	53°32.30'	031°02.60'	4376	2 + 12	Park
		12/08/98	14:25↑	54°39.99'	035°19.04'			
	414(F)	18/05/97	23:14↓	53°32.00'	031°01.90'	12615	6 + 8	North)
		16/08/98	18:40↑	57°12.24'	019°17.16'			
	405(F)	20/05/97	07:07↓	58°40.40'	020°38.40'	12613	15	ex Maury Channel
		18/05/98	06:10↑	60°24.47'	019°57.48'			

(#) Sea Scan version with SAIL clock device (new)
(F) WOCE version with FORTH downloading, compressed data format
↑ recover
↓ set

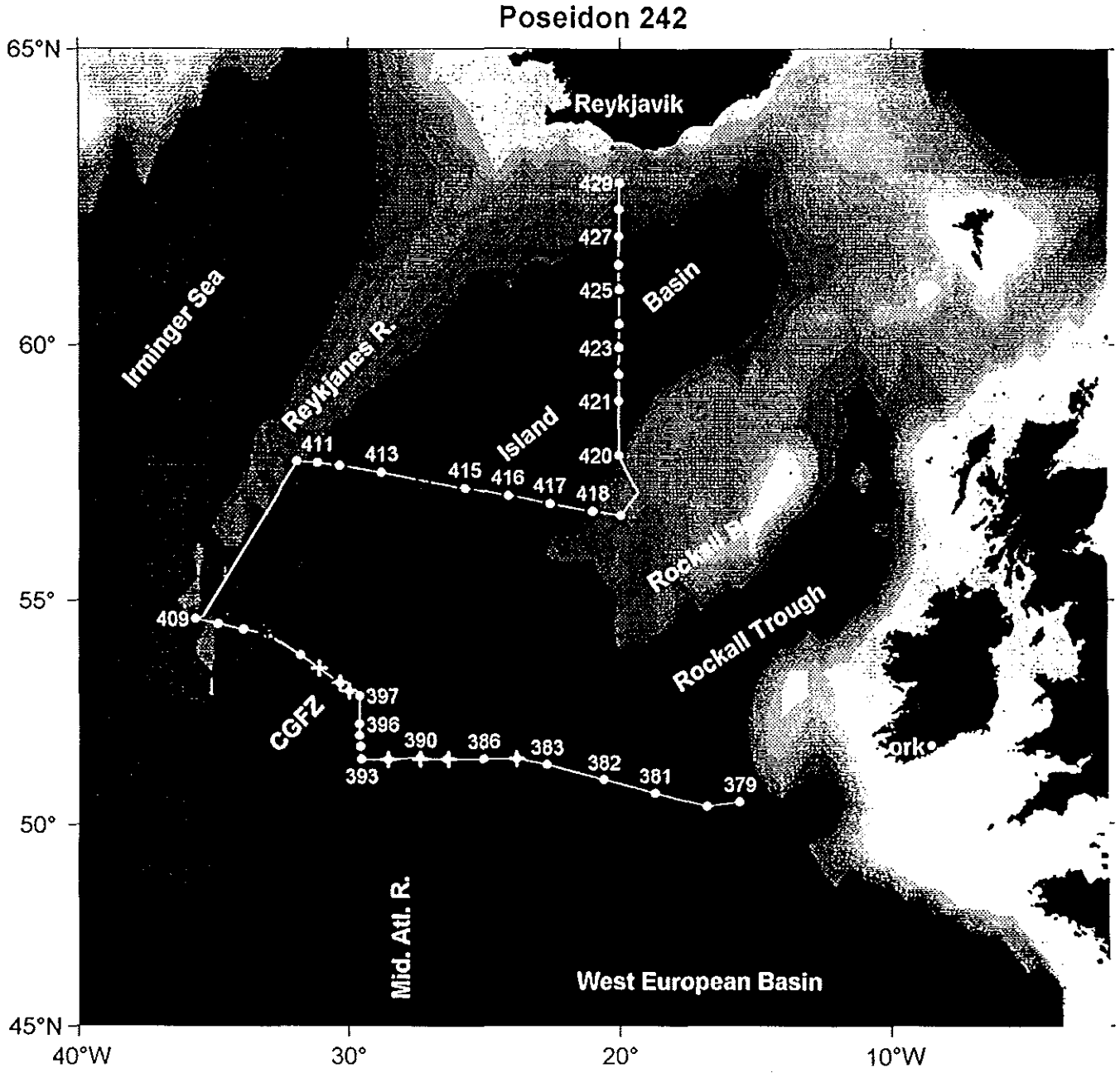


Fig 1: Chart of POSEIDON cruise 242 in August 1998. Dots denote CTD stations, circles label RAFOS float launch positions, crosses stand for mooring activities. For details see Tables 1 (CTD), 2 (mooring work) and 3 (RAFOS floats). CGFZ stands for Charlie Gibbs Fracture Zone.

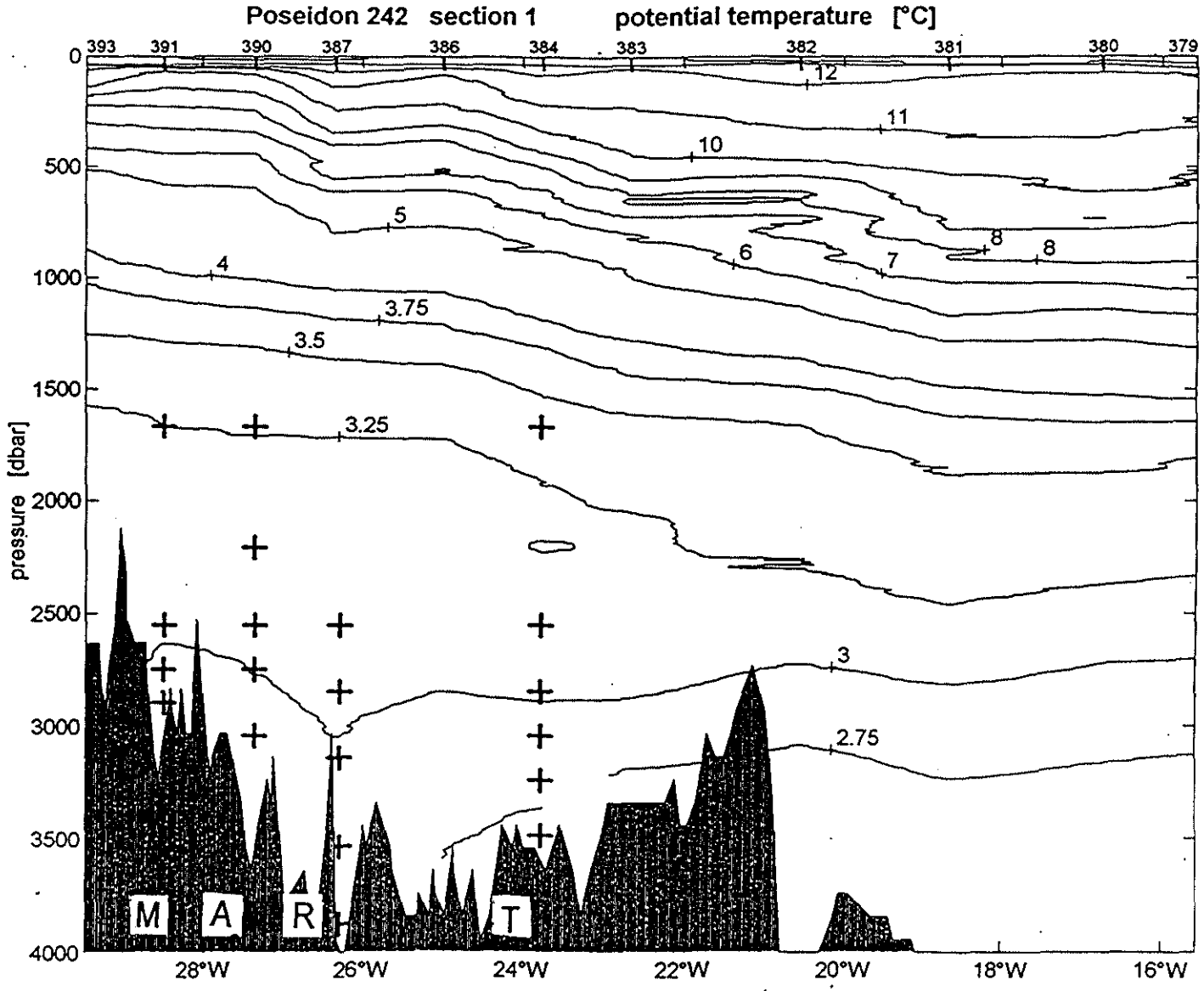


Fig 2: Hydrographic section of potential temperature (a) and salinity (b) between the Charlie Gibbs Fracture Zone and the Porcupine Bank west of Ireland. Crosses mark current meters moored during the cruise POSEIDON 242. The sequence of moorings is called from West to East: **M A R T**, standing for Middle

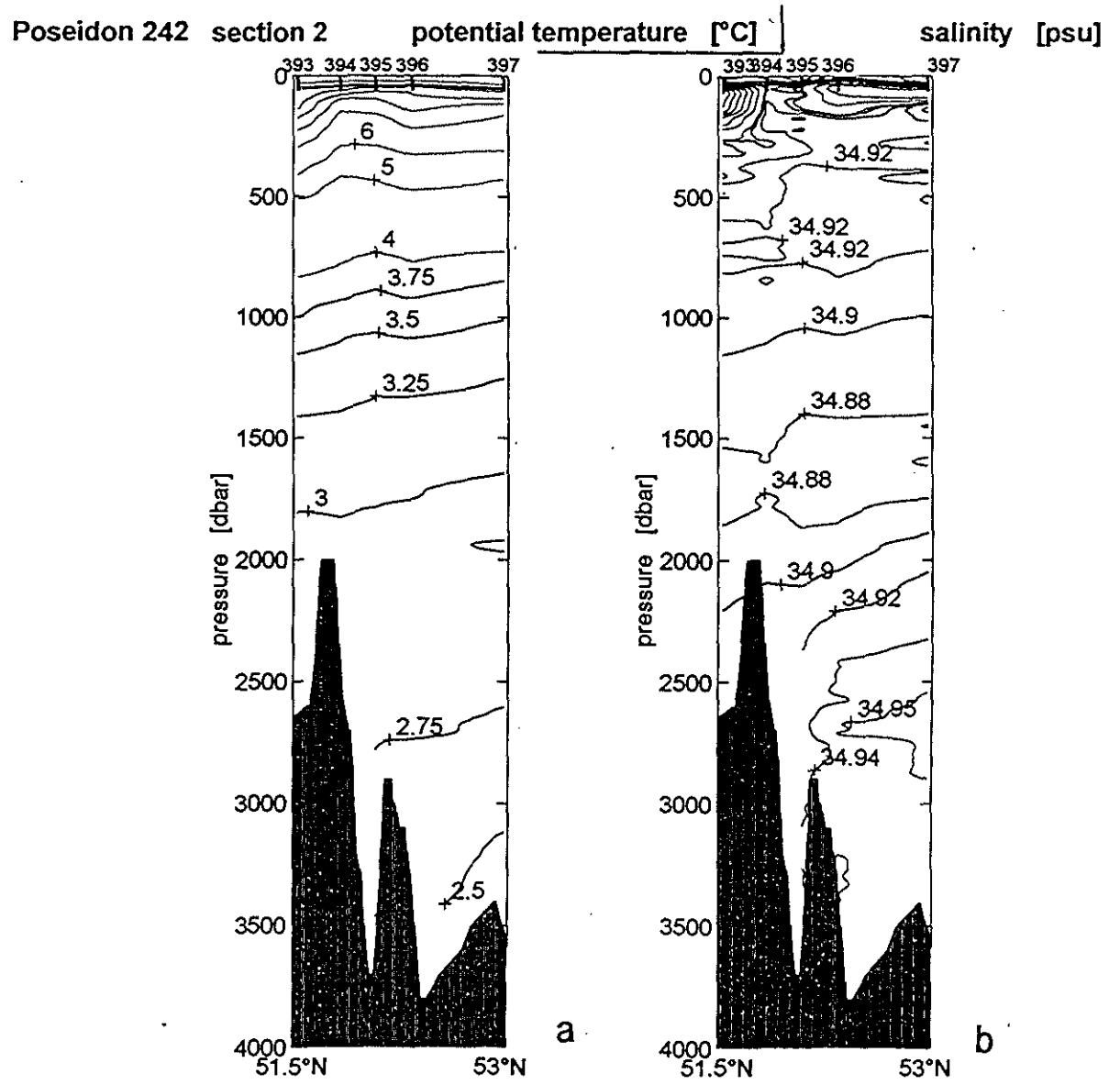
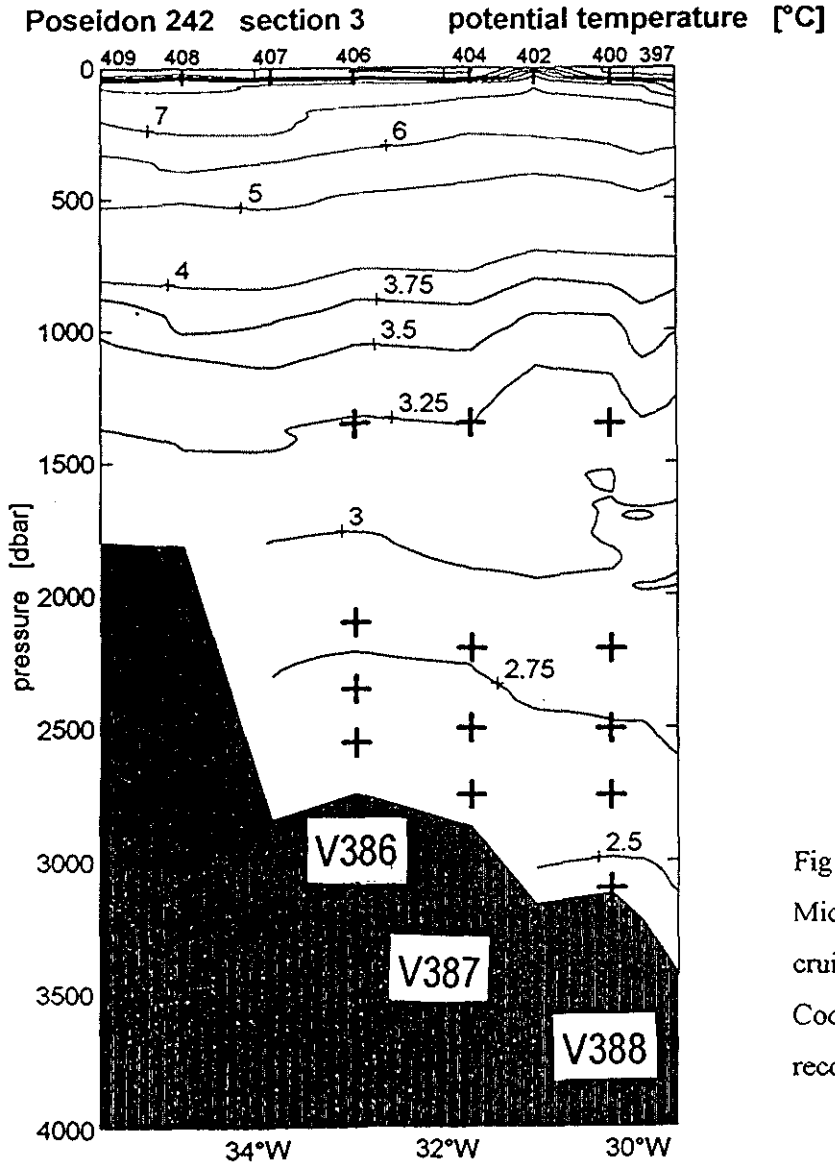
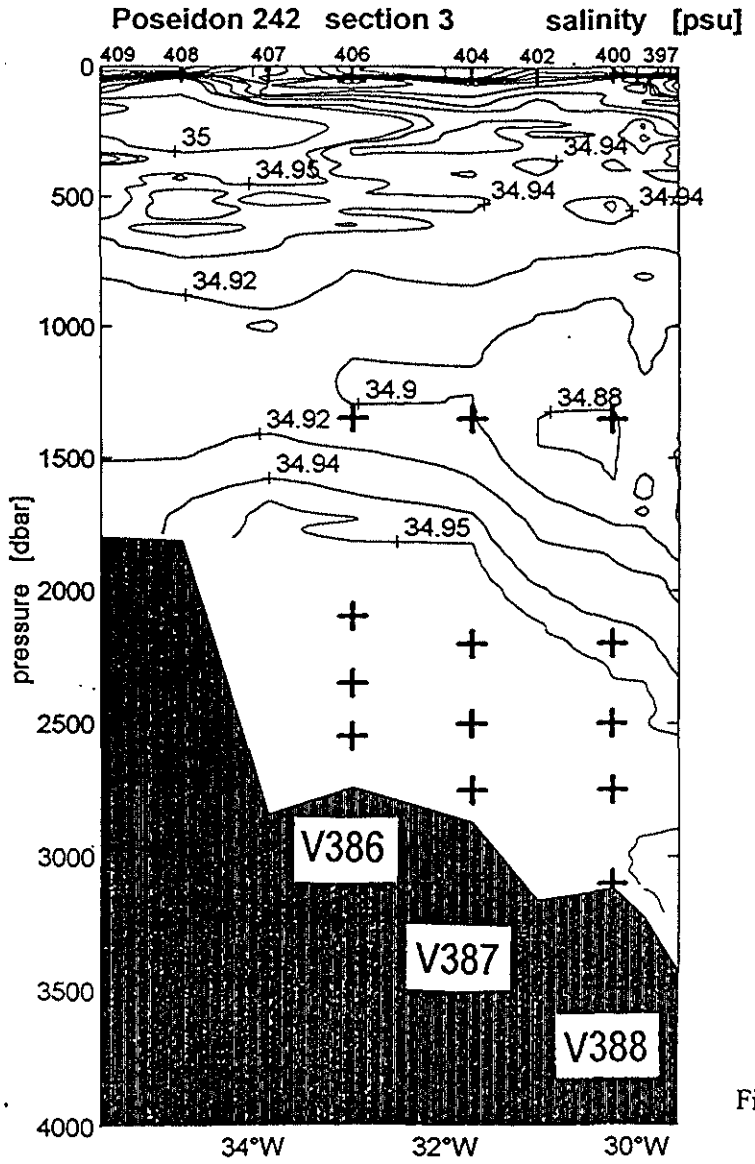


Fig 3: Hydrographic section of potential temperature (a) and salinity (b) east of Charlie Gibbs Fracture Zone



a

Fig 4: Hydrographic section of potential temperature (a) and salinity (b) on the eastern flank of the Middle Atlantic Ridge. Crosses label depth levels of recording current meters recovered during the cruise POSEIDON 242. For details see Table 2. The operation of a RAFOS sound source (International Code IM3) was resumed by the redeployment of the center mooring V387 after the recovery of all recording current meters.



b

Fig 4 continued

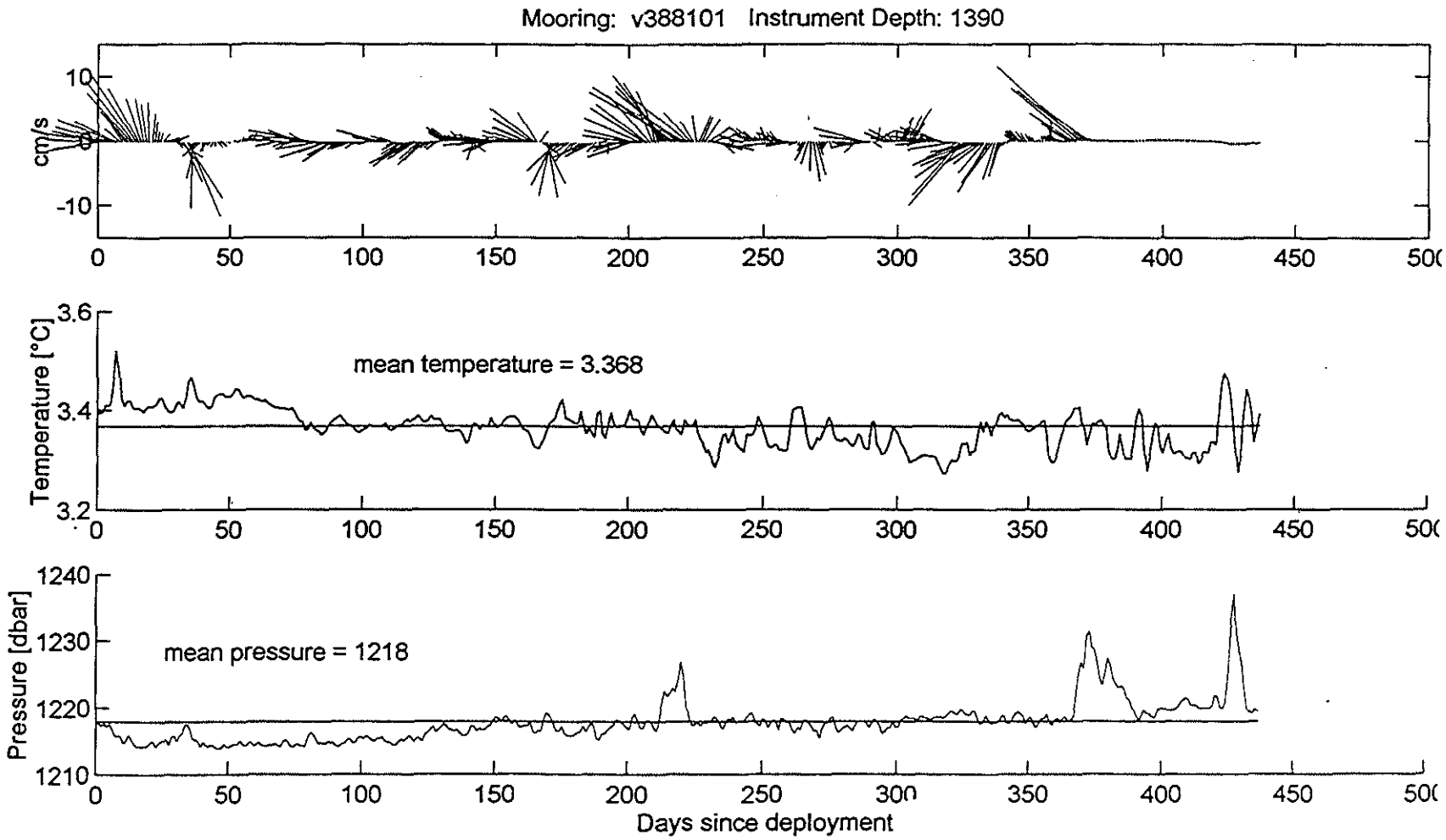


Fig 5: Preliminary time series of current vectors (top), temperature (middle), and pressure (bottom) from the upper instrument in mooring V388 on the outer flanks of the Middle Atlantic Ridge. For details of the deployment parameters see Table 2.

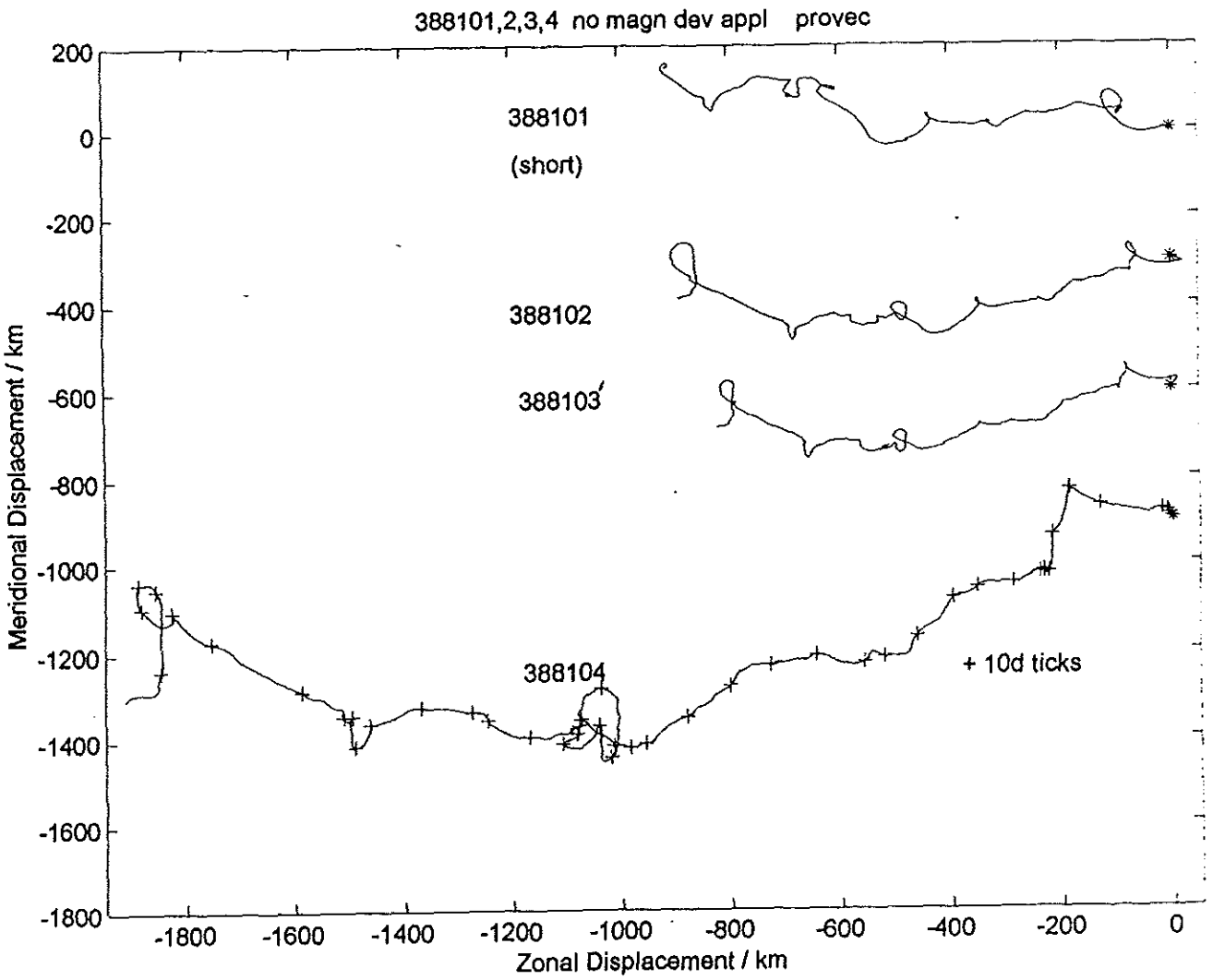


Fig 6: Preliminary progressive vector diagrams of the upper four instruments in current meter mooring V388 on the outer flanks of the Middle Atlantic Ridge. Nominal depths were 1390, 2200, 2500 and 2750 m. For details of the deployment parameters see Table 2. No correction for the local magnetic deviation was applied on the shown vectors.

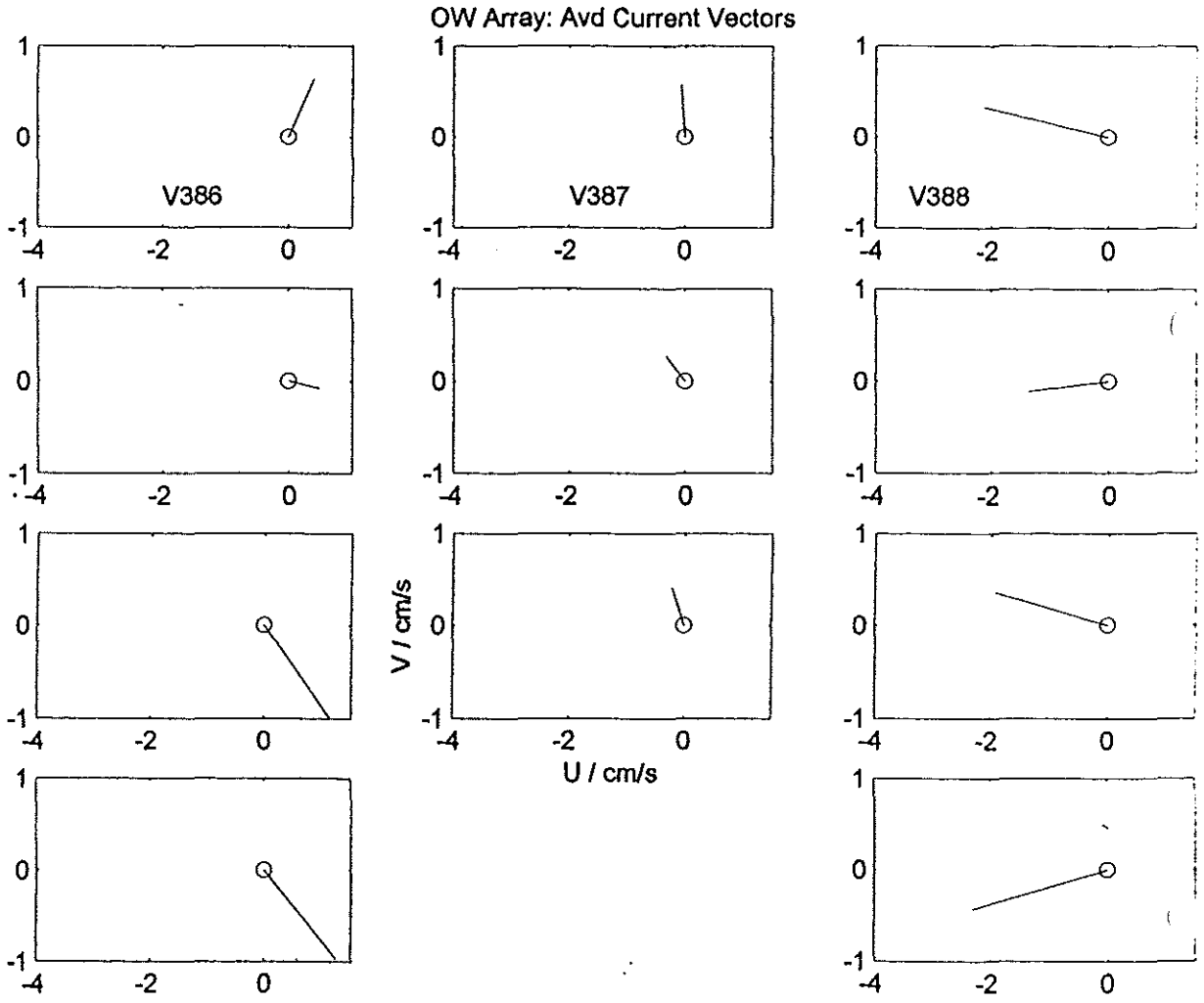


Fig 7: Preliminary summary plots of vector averaged velocity means from 15 month deployment time of the current meter array on the flanks of the Middle Atlantic Ridge north of Charlie Gibbs Fracture Zone. The plots are arranged in accordance with the geographical and vertical positions of the recording current meters. For details see the cruise chart (Fig 1) and Table 2.